OBSERVATIONS ON THE DIET OF FLAMINGOES

BY

M. W. Ridley

The following observations were made by the author in Kenya Colony between 1951 and 1953. During these years all the lakes inhabited by flamingoes were visited and specimens collected with a view to the collection of data on the habits, occurrence and natural history of one of East Africa's most colourful, yet least known birds.

In Kenya flamingoes are found on the lakes of the Great Rift valley. The 'Soda' lakes are their real home, and they only seem to occur spasmodically on those lakes with a normal fresh water fauna, e.g. fish and higher plants which (with exceptions such as the small *Tilapia* found in Lake Magadi), cannot exist in the concentrated alkali of the former class of lake. Their headquarters are on Lakes Hannington, Nakuru, Magadi and Elmenteita, which are generally shallow and almost barren of life other than flamingoes. On drying these lakes deposit a layer of white soda (Na_2CO_3), which forms an unpleasant dust. As Africa becomes more arid, these lakes are much lower in level than formerly and, having no outlets, the concentration of salts has in many cases reached saturation point—for example, Lake Magadi where the soda and also Common Salt (NaCl) are mined commercially, and Lake Nakuru which is now dry except during the rains. There is evidence that the lower level of water and thus the greater concentration of salts, has resulted in a greatly increased population of flamingoes in Lake Elmenteita.

The most numerous of the two species occurring is the Lesser Flamingo [*Phœniconaias minor* (*Geoffroy*)]. In Lake Hannington, in July 1953, out of a total population of over 2 million, more than 99% were of this species, but when their characteristic food is absent, as it was at Lake Elmenteita in December 1951, the only birds seen are the Greater Flamingo [*Phœnicopterus ruber roseus* (*Pallas*)]. These appear to be largely migratory, spending only the palæarctic winter in Kenya, yet individuals are to be seen throughout the year even as far south as the Union of South Africa. There is, however, no proof of breeding anywhere in the African continent, but it may yet be found to breed somewhere. The lesser species undoubtedly does so but apparently at intervals and only spasmodically, but the author believes that their main breeding place has yet to be discovered.

Observations of the feeding habits and occurrence of the two species were made at most of the lakes, and the gut contents of some forty individuals were examined under the microscope. The results of these examinations are given in detail in a table following this paper.

This table makes it clear that the two different species have substantially different diets, as is borne out by the differences in bill structure, and also in the methods of feeding employed.

The Greater Flamingo's bill is much less highly specialised than the Lesser's and consists of a smaller area of 'straining surface'. These surfaces, chiefly on the upper mandible, (which becomes the lower when the bird is feeding) are composed of parallel rows of 'ridges' or laminae which are visible to the naked eye. Without, in this note, going too deeply into the function of this structure it may be said that the bill of the Greater Flamingo is only capable of straining comparatively large objects out of the water or mud and in this sense may be regarded as analagous to that of a typical duck.

The lesser species, on the other hand, not only possesses a much greater area of straining surfaces but is also much more capable of straining the finer organisms on which the bird feeds, because the laminae or ridges are equipped with fine hairs protruding from them which can effectively sieve objects as small as diatoms.

In feeding, the Greater Flamingo generally though not invariably immerses the whole head and the bill is buried in the mud on the floor of the lake. The head is then swung from side to side with the bill inverted, while the bird walks slowly forwards. The Lesser Flamingo, however, does not normally immerse its head but skims the surface of the water with a semicircular motion, with the bill inverted and the 'upper' mandible just beneath the surface. Either species swims freely in deep water when feeding, and Greater Flamingoes sometimes 'up-end' like swans.

A significant difference in the average size of the grit, which forms a large proportion of the stomach contents has also been noticed, that in the Greater Flamingo being much larger. The function of the grit is to grind the food in the gizzard.

It is concluded from these examinations that the Lesser Flamingo feeds more or less exclusively on blue-green algae and diatoms—and it is noteworthy that the only cases where this does not hold good are those of two birds secured at Lake Elmenteita in 1951, which were both damaged birds unable to fly and therefore left behind by the vast flocks of their species which are normally to be seen there. At this time blue-green algae were noticeably absent from the lake.

The Greater Flamingo, on the other hand, feeds on a great variety of foods, animal as well as vegetable, and from the small number collected it is difficult at this stage to say more. The published literature on the food of this species emphasises the diversity of the diet;—In India, Sálim Ali (1945) recorded the seeds of plants (e.g. *Ruppia*). In France, Gallet suggested that the organic content of the mud in the lagoons of the Camargue might constitute a food supply. In America, the subspecies *Ph. ruber ruber* feeds on the marine snail *Cerithium* (F. Chapman, 1908), but not exclusively so (Zahl, 1953). In the Red Sea the old world subspecies has been recorded feeding on a similar mollusc (Lord W. Percy, *in litt.*). It seems, therefore, that the Greater Flamingo is much less specialised in its diet than the lesser species.

Several observers have commented on the inadequate food supply in the barren, highly alkaline waters of the known breeding grounds of the Greater Flamingo, such as the Camargue, the Guadalquivir delta and the Rann of Cutch. As the author has never visited

these places it is dangerous to give an opinion, but it is perhaps worthy of note that:

(1) Flamingoes feed for relatively long periods during the day.

(2) The Flamingo has the longest Meikel's tract of any bird, (Meikel's tract is the absorptive part of the alimentary canal).

(3) There is an immense quantity of rich orange fat, containing carotine, on healthy flamingoes which might act as a reserve of food during the breeding season. Definite conclusions, however, are not attempted here.

The author is hoping to prepare a further paper on flamingoes and would be particularly interested in any observations by members of the Natural History Society of Bombay. Any information about these birds in India—particularly as to diet, breeding and migration —would be most welcome.

Diet of Flamingoes

Table showing results of examination of stomachs

(*a*) *Greater Flamingo*

Date	Place	Gut contents,
Dec. 1951	Elmenteita	Chiefly Chironomid larvæ ; a trace of Corixids.
Dec. 51	,,	Chironomid larvæ ; a few sedge seeds.
Dec. 51	,,	Chironomid larvæ ; a few Copepods.
Nov. 52		Small quantities of Chironomid larvæ,
Dec 52	"	Copepods, Corixids, Sedge Seeds.
Apr. 53	,,	Sedge Seeds. Algæ and Diatoms. Various Insect larvæ.
July 53	Hannington	Higher plant remains (leaves). Insect larvæ.
July 53	,,	Ditto.

(*b*) *Lesser Flamingo*

Dec. 51	Elmenteita	Abundant Corixids ; Some Chironomids and Seeds.
Dec. 51	,,	Seeds only.
Dec. 52	,,	Blue-Green Algæ (*Myxophyceæ*) (4 Birds examined).
Mar. 53	Naivasha	Diatoms (*Bacillariophyceæ*) (4 Birds examined).
Apr. 53	Elmenteita	Blue-Green Algæ.
June 53	,,	Blue-Green Algæ. (4 Birds examined).
July 53	Hannington	Blue-Green Algæ. (11 Birds examined).
Sep. 53	Rudolf.	Blue-Green Algæ.

From this it appears fairly conclusively that the staple food of *P. minor* is Algae. The exact specific determination of the Algae has not yet been completed, but the genera *Arthrospira* and *Oscillatoria* have been identified, among the Blue-Green Algae, and *Navicula* among the Diatoms.

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